

UNIVERSITI TEKNOLOGI MARA

**PREPARATION OF
MAGNESIUM-ALUMINIUM
AND ZINC-ALUMINIUM
BASED LAYERED DOUBLE
HYDROXIDES AND THEIR
ADSORPTION PROPERTIES IN
ANIONIC DYE REMOVAL**

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of the requirements for the degree of
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AUTHOR'S DECLARATION

I declare that the work in this thesis was carried out in accordance with the regulations of Universiti Teknologi MARA. It is original and is the result of my own work, unless otherwise indicated or acknowledged as referenced work. This thesis has not been submitted to any other academic institution or non-academic institution for any degree or qualification.

I hereby, acknowledge that I have been supplied with the Academic Rules and Regulations for Post Graduate, Universiti Teknologi MARA, regulating the conduct of my study and research.

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ABSTRACT

Layered double hydroxides (LDHs) have been prepared by co-precipitation method containing different ratios of Mg^{2+} , Zn^{2+} and Al^{3+} in the brucite layers and different ions of NO_3^{2-} and CO_3^{2-} in the interlayer was used as an adsorbent for the removal of anionic dyes from aqueous solution. LDHs were characterized by used of powder X-ray Diffractometer (PXRD), Fourier transform infrared spectroscopy (FTIR), Surface area analyser (BET) and Field emission scanning electron microscope (FESEM). PXRD analysis indicates that the crystallinity of the samples increased with the increased of Mg/Al and Zn/Al ratio. FTIR analysis shows the actual peak of LDHs functional group. BET shows that, the LDHs have high surface area and pore volume of $68.57 \text{ m}^2/\text{g}$ and 0.2532 cc/g . The Images from FESEM analysis exhibit the small flakes of dyes seem to be bound onto the MAN-4-LDH surface. Conventional optimization study was carried out by used of a single parameter at one time such as contact time, concentration, dosage and a solution pH. The results of the optimization study by used of conventional method for various dyes are as follows: golden yellow dye (7 h, 300 ppm, 0.5 g, pH 8) and amido black dye (8 h, 200 ppm, 0.04 g, pH 6). The optimization by used of response surface methodology (RSM) was carried out to remove golden yellow and amido black dyes from aqueous solutions using MAN-4-LDH. The parameters were contact time (1-3 h), solution pH (4-10), adsorbent dosage (0.02-0.04 g) and dye concentration (75-200 mg/L). The optimum conditions derived via RSM during the reaction were a reaction time of 2.98 hours, a dye concentration of 185.74 mg/L, a solution pH of 5.24 and an adsorbent dosage of 0.03 g. The experimental percentage removal was 89.58% under optimum conditions, which compared well with the maximum predicted value of 87.83 %. The parameters used for optimization by used of RSM for amido black dye were contact time (6-8 h), solution pH (4-8), adsorbent dosage (0.2-0.6 g) and dye concentration (50-100 mg/L). The optimum conditions derived via RSM during the reaction were a reaction time of 8.48 hours, a dye concentration of 58.09 mg/L, a solution pH of 6.27 and an adsorbent dosage of 431.24 mg/L. The experimental percentage removal was 85.55 % under optimum conditions, which compared well with the maximum predicted value of 87.95 %.

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